

The Tectonic Evolution of Two Buried Hill Structures and Their Reservoir Potential in Liaodong Bay

Chen Zhang¹

¹China University of Petroleum, Beijing

Abstract

Liaodong Bay area has experienced complex tectonic evolution and this has led to the development of the Liaodong and Liaoxi buried hills structural belt. The most important control factor of hydrocarbon accumulation in the buried hills is the degree of reservoir development inside the buried hill; reservoir quality is closely related to lithology, structure of bed rock, evolution process, and the secondary transformation. Using new geological and seismic data, together with existing knowledge of the regional tectonic history, we study the heterogeneity of lithology and structure of buried hills, their formation mechanism, as well as analyze the hydrocarbon accumulation condition through the control factors of reservoir development, hydrocarbon translocation system, and cap condition of the two buried hills. The results show that the bedrocks of different lithologies are different in outcrop range on the plane, and the stratigraphic structure varies from the different parts in vertical direction. This heterogeneity is explained by differences in their formation and tectonic evolution. The Liaoxi buried hill structure, which formed before the Liaodong structure, underwent multiple phases of inversion after extensional rifting in the Mesozoic-Early Cenozoic period. The rocks of the Liaodong buried hill structure were originally part of the Jiao Liao paleo-uplift, but became separated from it during the Eocene by sustained strike-slip faulting, which also formed the Tan-Lu fault belt and the nascent Liaodong buried hill. Regional extrusion inversion and wrench strike-slip faulting on the Tan-Lu fault zone during the Later Oligocene caused further uplift of the Liaodong buried hill and changed the structure of Liaodong Bay from a "two sags clip an uplift" to "three sags clip two uplifts". The complex, multiphase structural evolution of the two buried hills improved their reservoir potential and formed multiple hydrocarbon migration pathways. Potential cap rocks inside the structures include the Mesozoic Sha-3 member and the Dongying Formation. Given their different stratigraphic and structural evolution, we suggest that the hydrocarbon source-rock potential, reservoir and cap-rock conditions of the Liaodong buried hill are less favorable than those of the Liaoxi buried hill; however, late strike-slip faulting may have reduced the oil and gas reservoir potential of the Liaodong buried hill to a level below that of the Liaoxi buried hill.